TMDL PUBLIC MEETING

FOR THE DEVELOPMENT OF THE

Elizabeth River PCB TMDL

December 1, 2010

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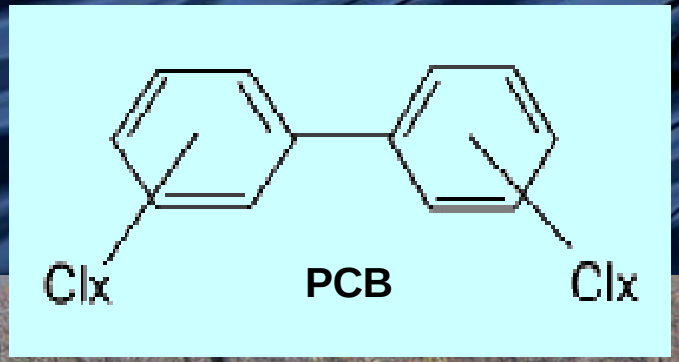
Presentation Topics

- Background
  - Fish monitoring & impairments
  - What is a TMDL?
- Why do we care about PCBs?
  - Legacy issue??
- Monitoring Results
- TMDL Process



Environmental Monitoring & Assessment

- The Clean Water Act requires the Department of Environmental Quality (DEQ) to:
  - Collect/analyze water and fish samples
  - Assess the samples by comparing to water quality standards (WQS = narrative or numeric)
    - Designated Uses
      - Primary Contact (Swimming)
      - Aquatic Life
      - Fish Consumption
      - Public Water Supply
      - Shellfish consumption

DEQ Fish Tissue Monitoring

- Monitor to assess the "Fishable" Goal of the Clean Water Act
- Target lipophilic or "fat loving" contaminants that accumulate in tissue
  - PCBs, Pesticides, etc.
- Compare to fish trigger values

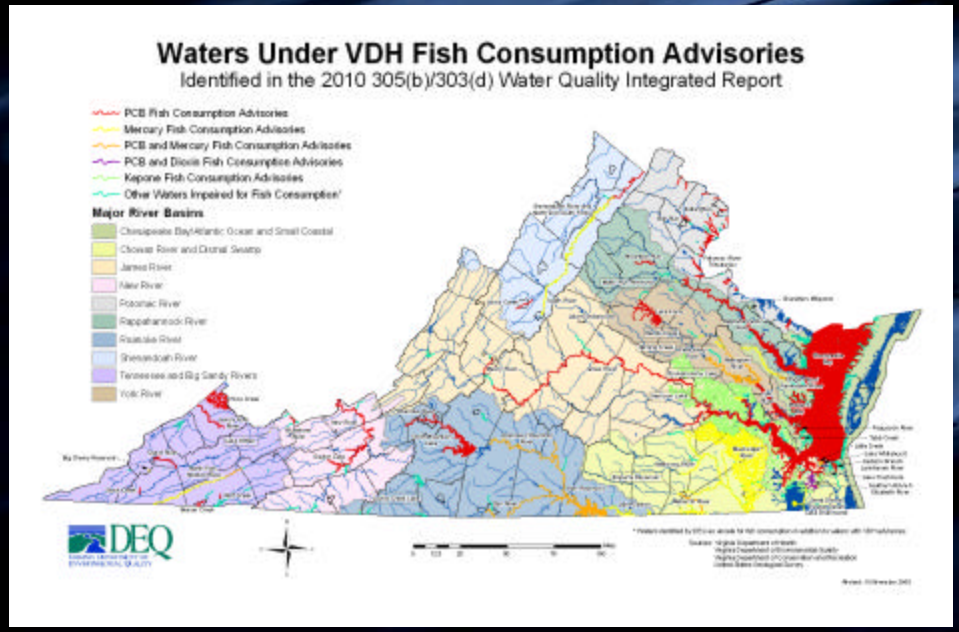
VA Regulatory Criteria

Consumption Advisories Fish Tissue (ppb)	Water Quality Criterion Total PCBs (ppb)
VDH 50	~~0.0017~~ ~~(old)~~
DEQ (screening) 20	→ 0.00064 (new)

WQC represents target concentration in the water column that minimizes the bioaccumulation of tPCBs in fish for protecting human consumption

Environmental Assessment

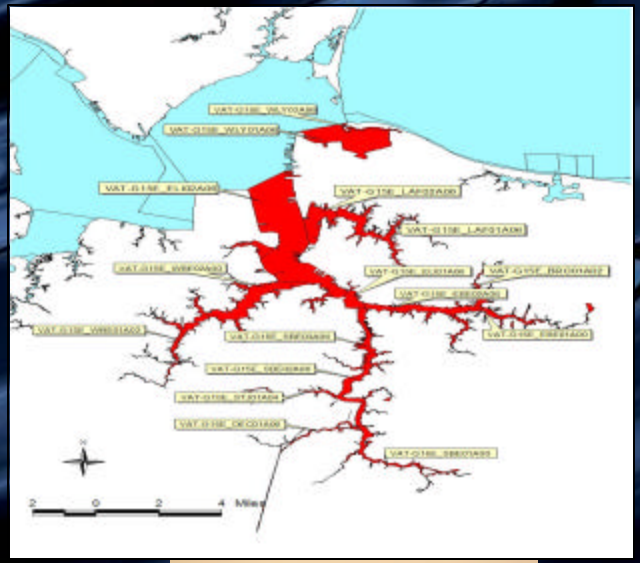
- Problem waters are identified in the 305(b)/303(d) Integrated Report (2 year cycle)
  - Impaired waters (exceedence of trigger values)
- TMDL required for impaired waters (State & Federal Law)



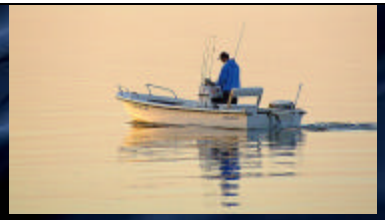
Elizabeth River Fish Consumption Advisory (VDH) for PCBs

Willoughby Bay and the Elizabeth River system (Western Br., Eastern Br., Southern Br., and Lafayette River) and tidal tributaries St. Julian Creek, Deep Creek, and Broad Creek

Fish Species	Advisory
Gizzard Shad, Carp, Blue Catfish & Flathead Catfish ≥ 32 inches	**Do Not Eat**
Blue Catfish & Flathead Catfish < 32 inches, Channel Catfish, White Catfish, Largemouth Bass, Bluegill Sunfish, **American Eel**, Quilback Carpsucker, Smallmouth Bass, Creek Chub, Yellow Bullhead Catfish, **White Perch**, **Blueback Herring**, **Striped Bass**, Hickory Shad, **Croaker, Spot, Bluefish**	**No more than two meals/month**



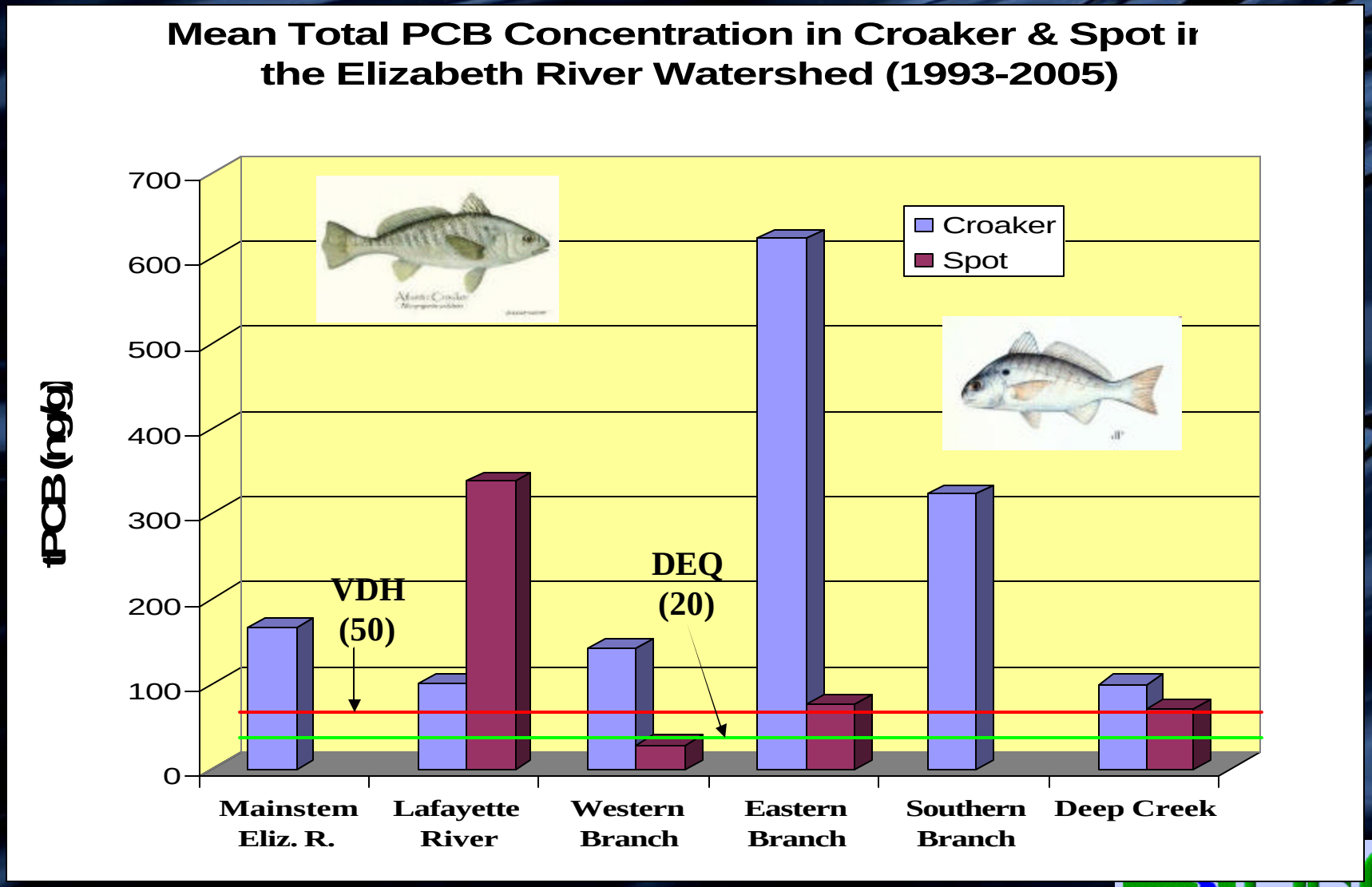
Southern Branch of the Elizabeth River and its tidal tributaries



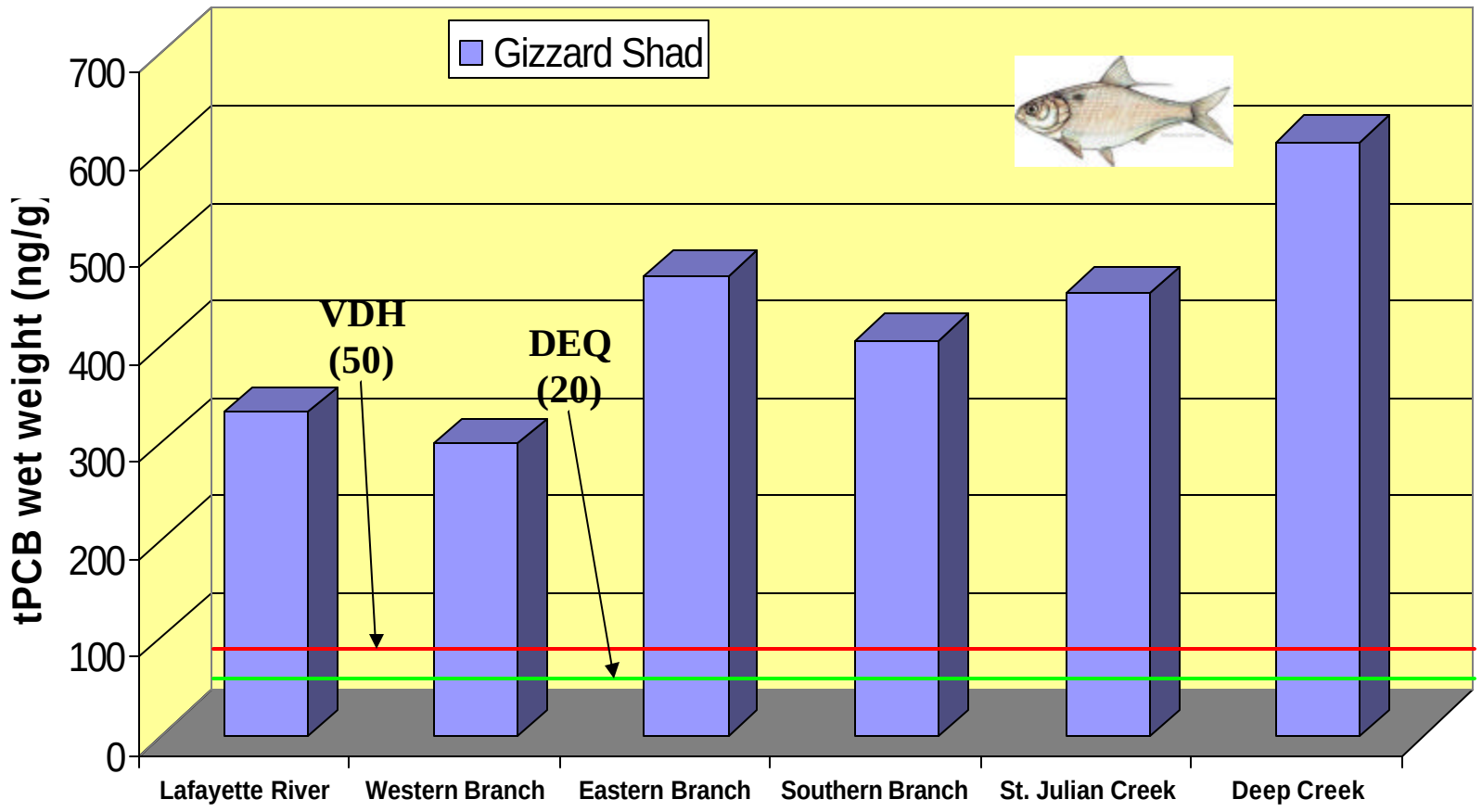
DO NOT EAT crab's hepatopancreas ("mustard," green gland, tomalley). Only applies to eating the "mustard". Crab meat is not subject to this advisory

DEQ

Fish Tissue Results

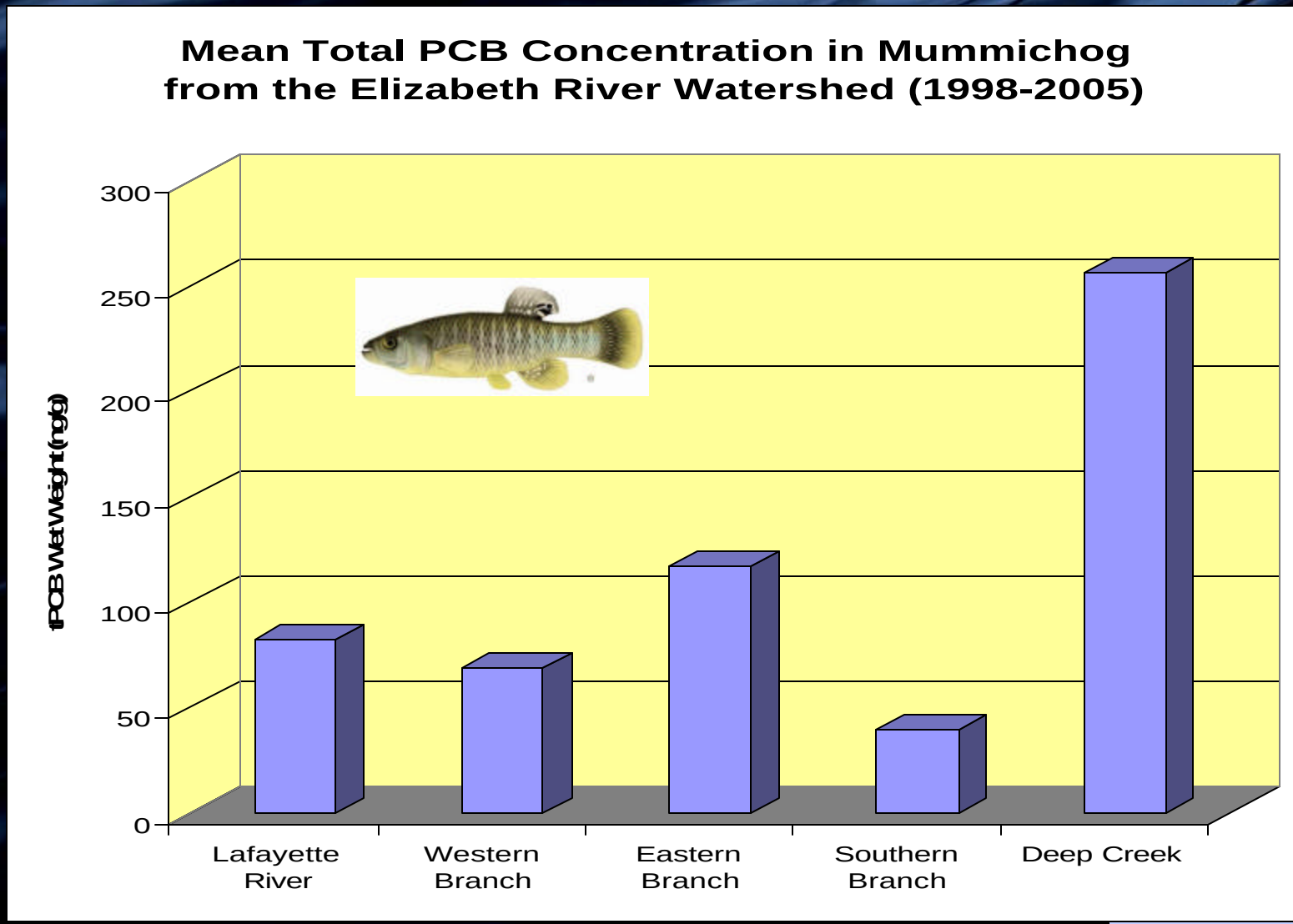


Fish Tissue Results



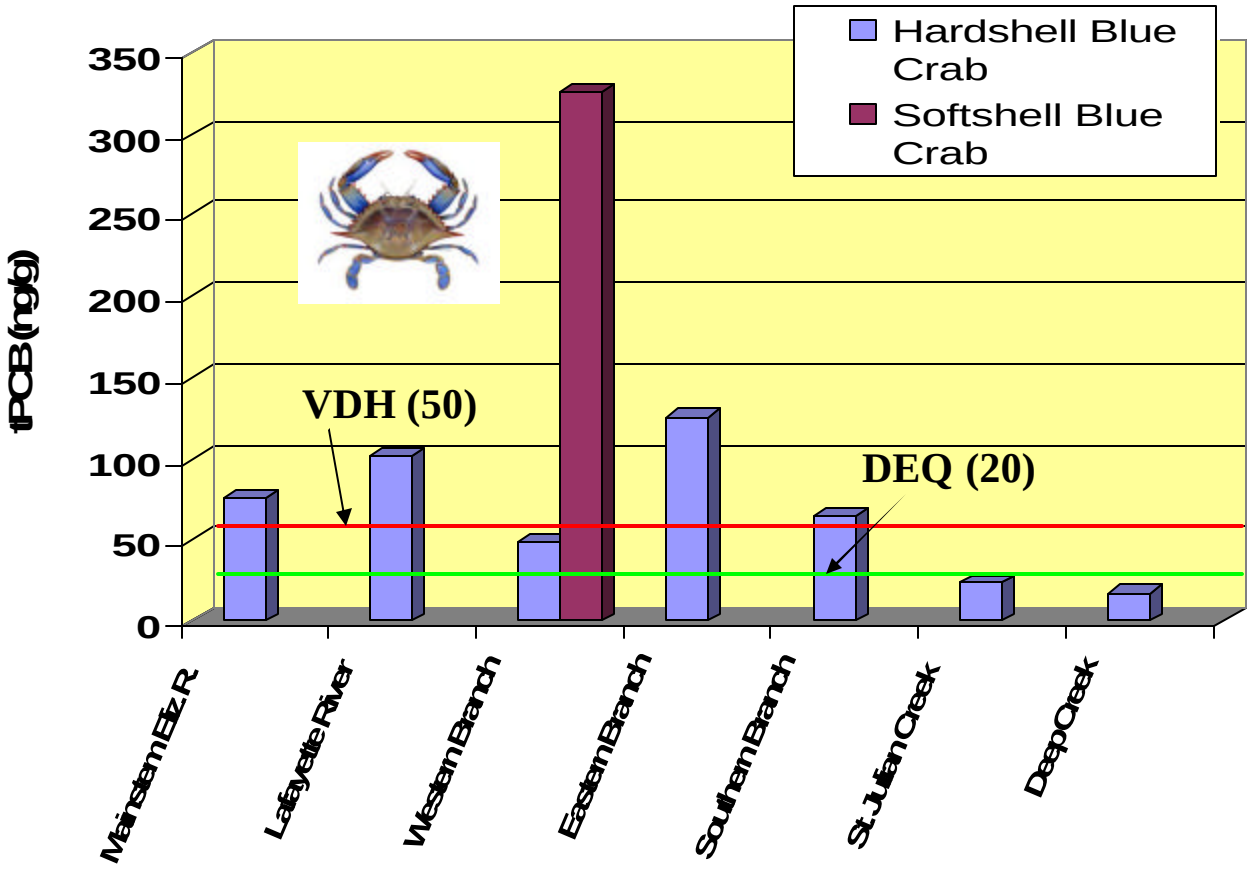
Fish Tissue Results

Resident Species



Fish Tissue Results

Mean Total PCB Concentration from Blue Crabs Collected in the Elizabeth River Watershed (1993-2005)



What is a TMDL or Total Maximum Daily Load?

TMDL = maximum amount of a pollutant that can exist in a waterbody without violating water quality standards (WQS)

Goal = restore impaired waters

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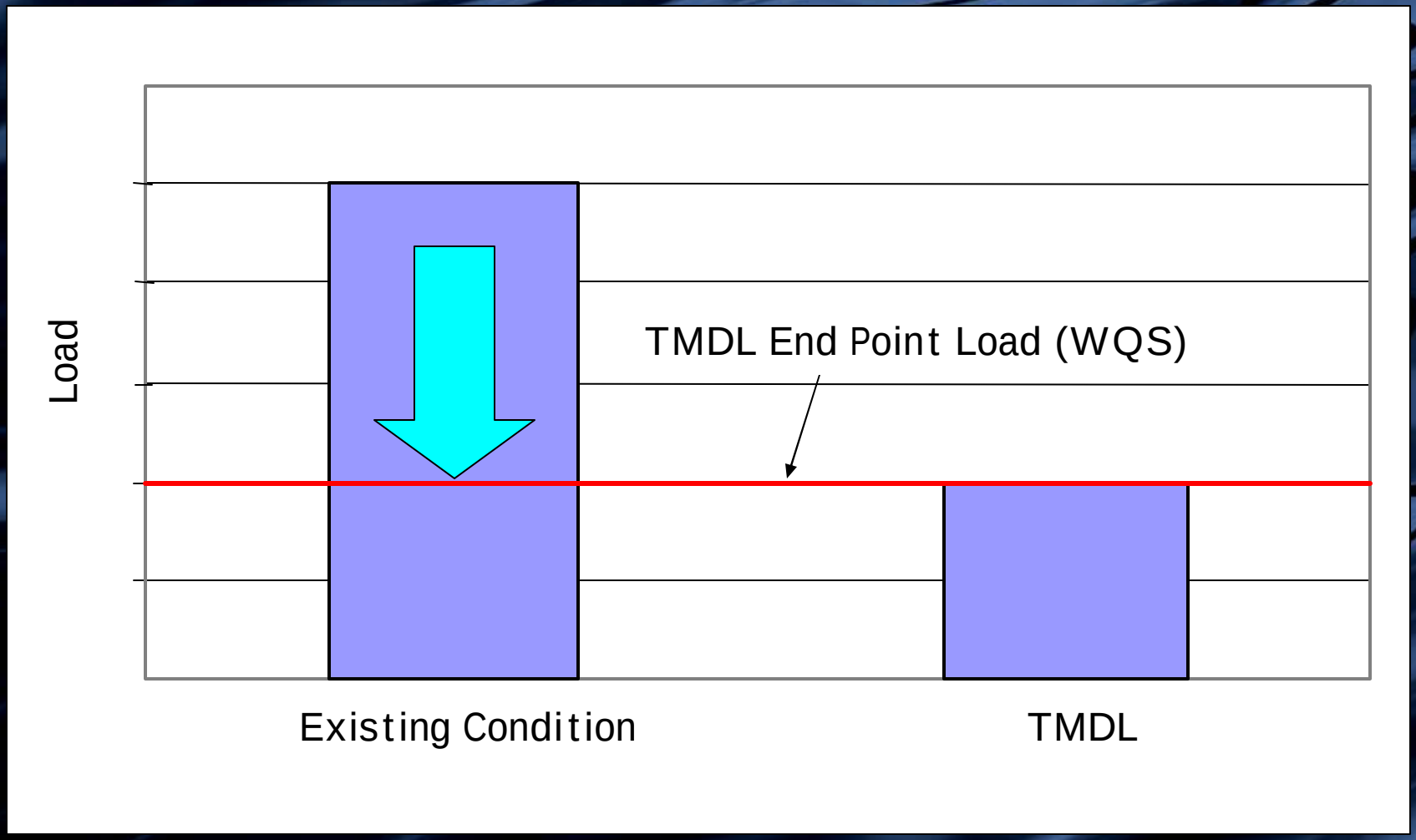
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

An Example TMDL



Reducing existing pollutant load to the TMDL end point load is expected to restore water quality

Why are TMDL Studies Necessary?

- Federal & State Laws
  - 1972 Clean Water Act (section 303d)
  - 1997 Water Quality Monitoring, Information and Restoration Act (WQMIRA)
  - 1999 Consent Decree (American Canoeist Association Lawsuit)
- Required in waterbodies where WQC not met for applicable designated use
  - Designated Uses
    - Primary Contact (Swimming), Aquatic Life, Fish Consumption, Public Water Supply, Shellfish consumption

How Does a TMDL Restore Impaired Waters?

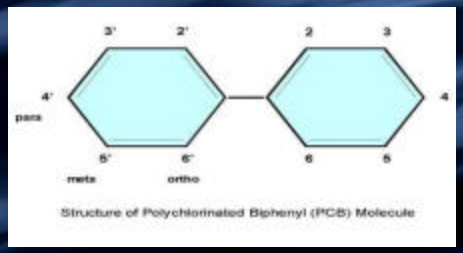
- TMDL process includes a special study that:
  - Identifies all significant pollution sources,
  - Calculates amount of pollution from each source, and
  - Calculates pollution reductions, by source, needed to attain water quality standards

What are the Steps in the TMDL Process?

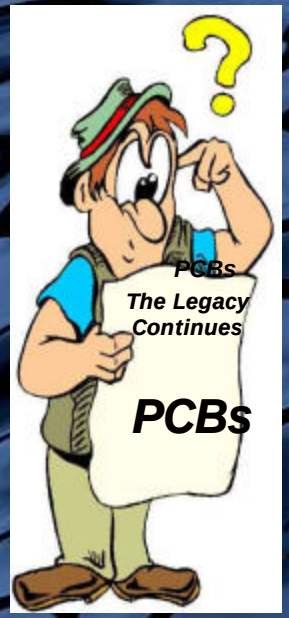
1. Public notice for TMDL development
2. TMDL Study with Public Meeting –
   - Monitoring and Modeling the Watershed
3. Public notice for Draft TMDL
   - Public Meeting with 30-day comment period
4. Submit to EPA for approval
5. State Water Control Board adoption of TMDL
6. TMDL Implementation Plan
7. Implementation of Corrective Actions Prescribed by Implementation Plan and Further Monitoring

What are PCBs?

- Biphenyl molecule (1-10 chlorine atoms)



Structure of Polychlorinated Biphenyl (PCB) Molecule



- 209 distinct PCB Compounds
- Regulated by VADEQ as Total PCB (tPCB) = 209 Compounds Summed
- Referred to as PCB Aroclors (Monsanto tradename) = mixture of PCB compounds

PCBs

- Estimated that > 1.5 Billion lbs. manufactured in the U.S. until 1977 - “Legacy Contaminant”
- Very stable and heat resistant
  - Persistent in environment
- Common uses:
  - Transformers, capacitors, hydraulic fluids, circuit breakers, PVC Products, carbonless copy paper, caulking material, paints, etc.

PCBs - A Legacy Pollutant?

- Banned in late 70's
- Accumulate and persist in river sediments from historic releases
  - "Hot Spots"
- Traditionally not detected under VPDES (permitting) Program

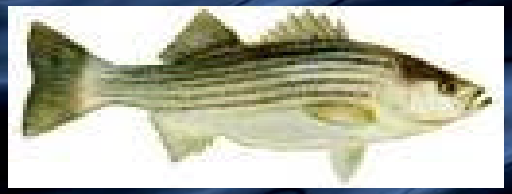
PCBs – Current Releases?

- PCBs used many years after banned
- Contaminated sites with active transport (non-point - e.g., CERCLA, RCRA, VRP, unknown)
- Point Sources
- Dielectric oils considered non PCB < 50 ppm
  - Fish advisories at 0.05 ppm
- Inadvertent production
  - Carbon + heat + chlorine
  - Up to 50 ppm allowed (TSCA)
- Atmosphere

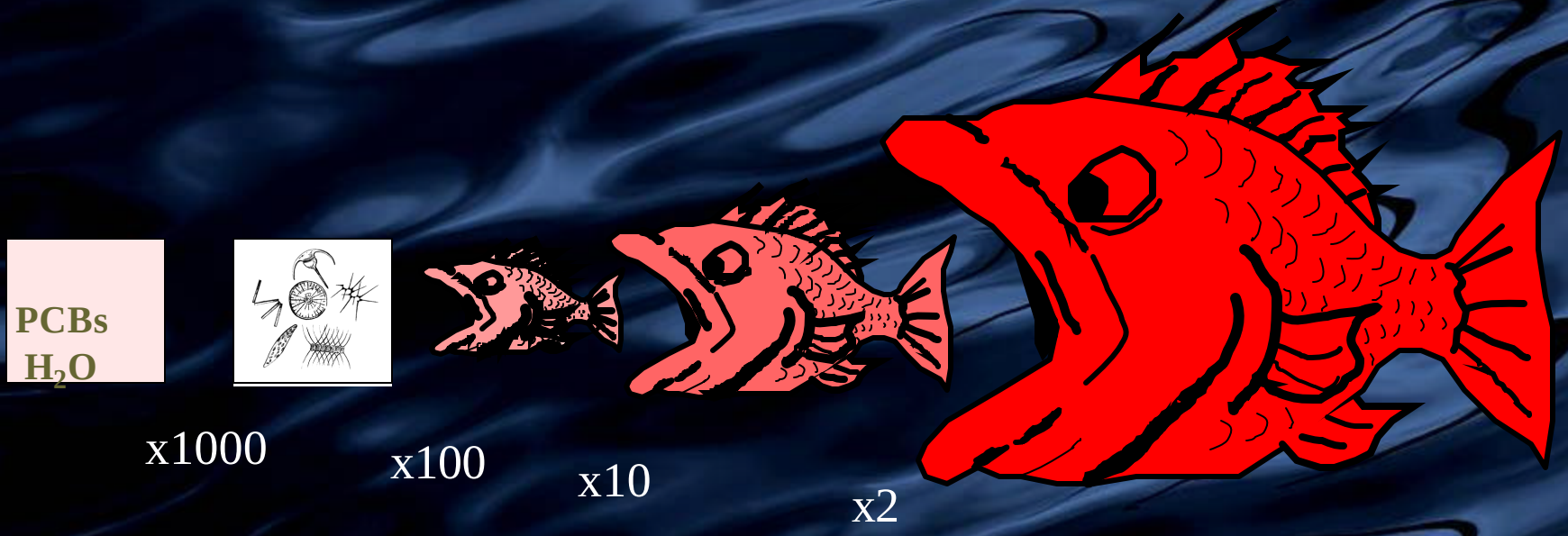
How Are Fish Exposed To PCBs?

- Intake through gills from water column
  - Basis of existing WQC (1980 EPA guidelines)
- Ingestion of contaminated sediment
  - Indirect uptake from foraging

- Exposure through skin from contaminated sediment (e.g. catfish)
- Ingestion of prey
  - Biomagnification



Biomagnification



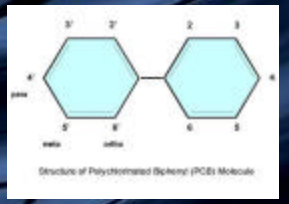
Concentration (parts per trillion)

0.001 1 1,000 10,000 20,000

PCBs – Why Important?

- Bioaccumulates at low conc. (lipids)
- Suspected carcinogen
- Other toxicological effects (humans)
  - Immunotoxicity, reproduction and developmental, hepatotoxicity (liver), neurotoxicity, and chloracne
- Major Sources of Exposure (humans)
  - Consumption of contaminated fish
  - Inhalation (dust from contaminated sites)

WQC = 0.00064 ug/L



Elizabeth River PCB Sampling

Spring 2009 & 2010

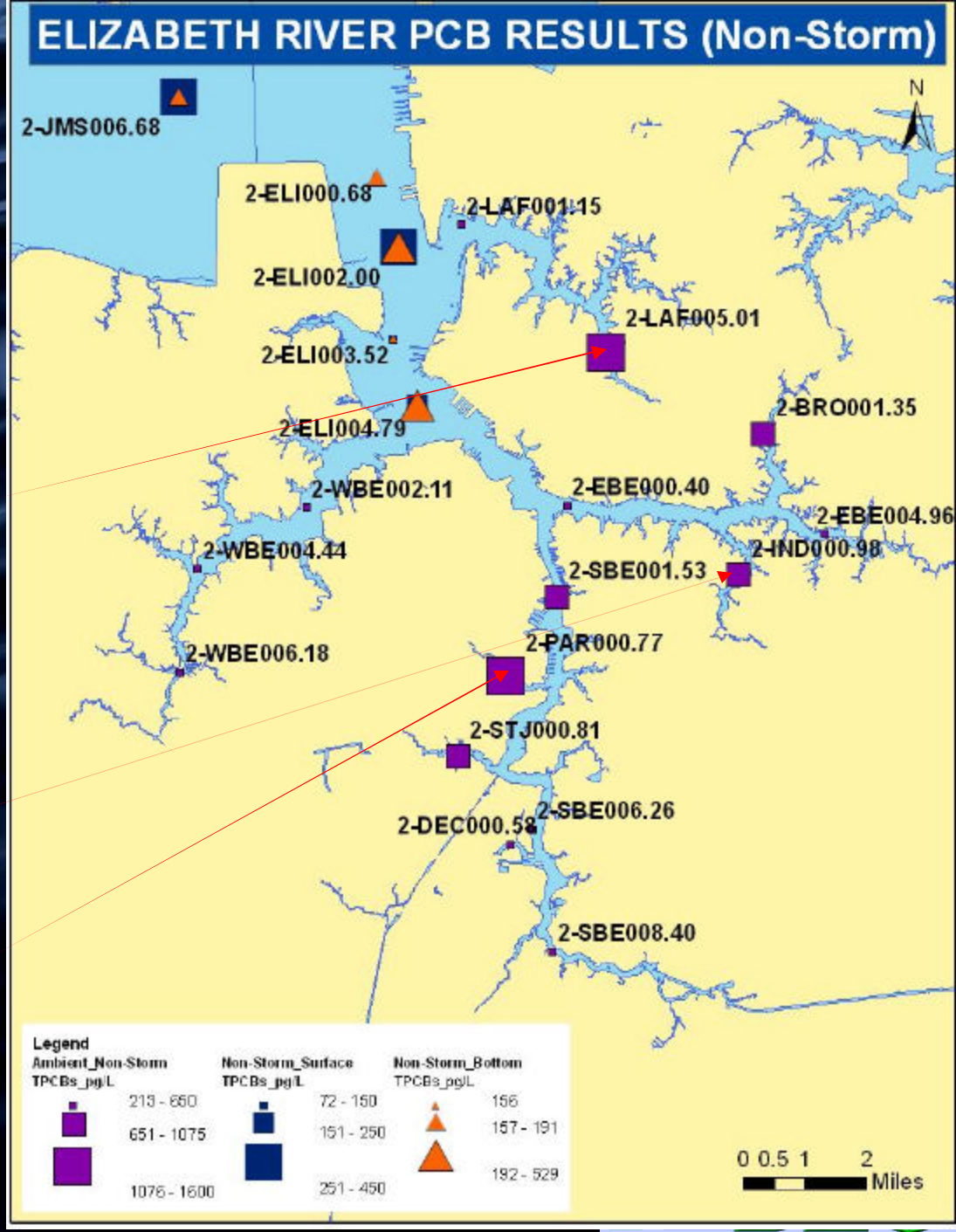
PCB Water Study

- Water samples collected April – June 2009 and at selected stations in May 2010
- Targeted wet and dry weather
- Used EPA Method 1668 for analysis
  - Low level detection method

2009 Non-Storm Data

Section	Station ID	Total PCBs (pg/L)
Main Stem	2-JMS006.68	449 / 191
	2-ELI000.68	130 / 184
	2-ELI002.00	345 / 529
	2-ELI003.52	72 / 156
	2-ELI004.79	214 / 510
Lafayette	2-LAF001.15	213
	2-LAF005.01	1,507
Western Branch	2-WBE002.11	218
	2-WBE004.44	311
	2-WBE006.18	243
Eastern Branch	2-EBE000.40	396
	2-EBE004.96	464
	2-IND000.98	1,066
	2-BRO001.35	896
Southern Branch	2-SBE001.53	854
	2-PAR000.77	1,089
	2-STJ000.81	849
	2-SBE008.40	231
	2-SBE006.26	416
	2-DEC000.58	565

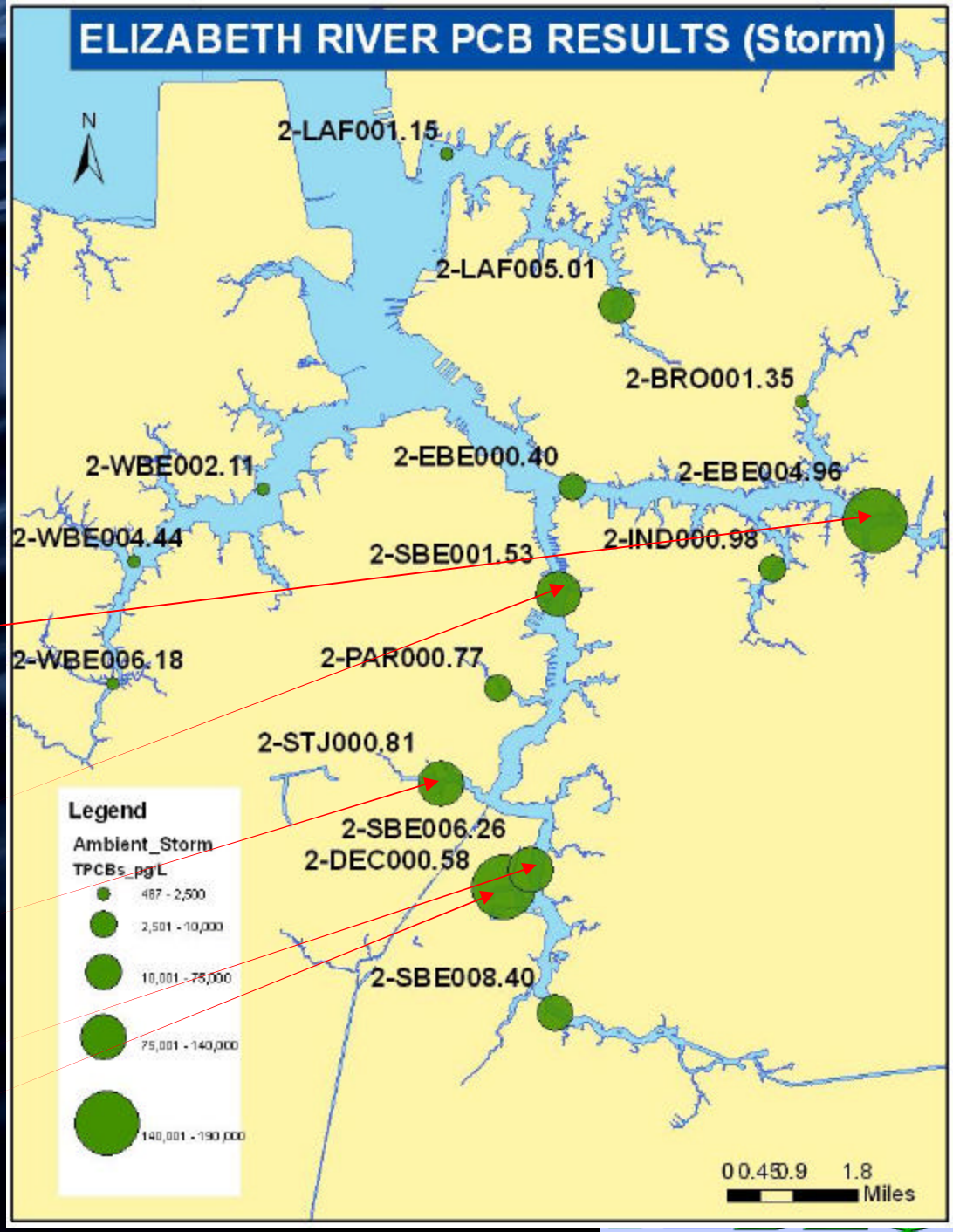
WQC = 640 pg/l



2009 Storm Event Data

Section	Station ID	Total PCBs (pg/L)
Lafayette	2-LAF001.15	487
	2-LAF005.01	73,417
Western Branch	2-WBE002.11	906
	2-WBE004.44	696
	2-WBE006.18	580
Eastern Branch	2-EBE000.40	99,974
	2-EBE004.96	187,542
	2-IND000.98	2,513
	2-BRO001.35	1,035
Southern Branch	2-SBE001.53	100,054
	2-SBE001.53	5,339
	2-STJ000.81	109,085
	2-SBE008.40	72,461
	2-SBE006.26	121,053
	2-DEC000.58	140,182

WQC = 640 pg/l



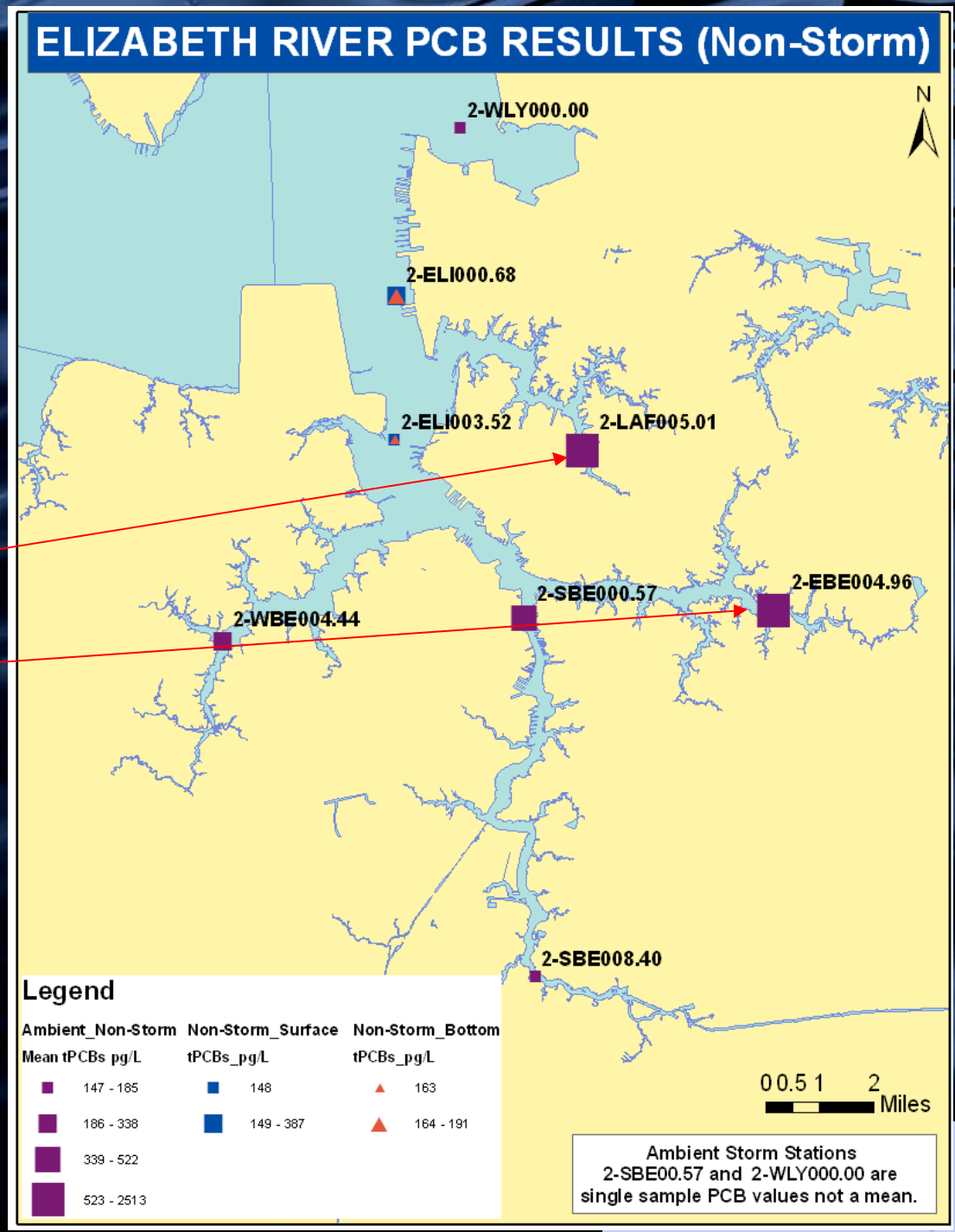
Non-Storm Event Data

2009 & 2010

Section	Station ID	Mean PCBs (pg/L)
Main Stem	2-ELI000.68	386/ 190
	2-ELI003.52	148/ 163
Willoughby	2-WLY000.00	147
Lafayette	2-LAF005.01	2512
Western Branch	2-WBE004.44	338
Eastern Branch	2-EBE004.96	1809
Southern Branch	2-SBE000.57	522
	2-SBE008.40	185

WQS = 640 pg/l

Stations 2-ELI000.68 & 2-ELI003.52 represent the mean of 2 Surface & 2 bottom samples



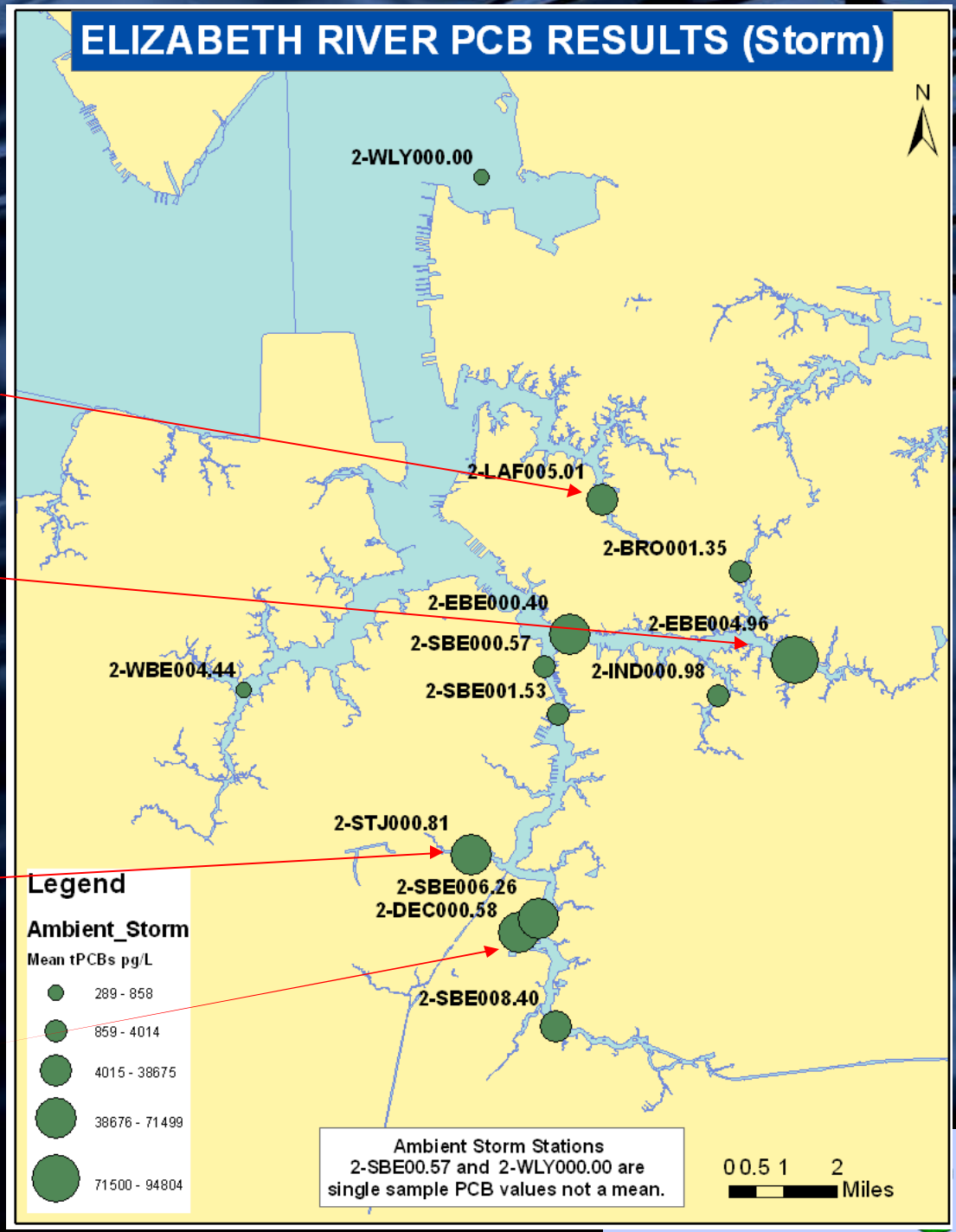
Storm Event Data

2009 & 2010

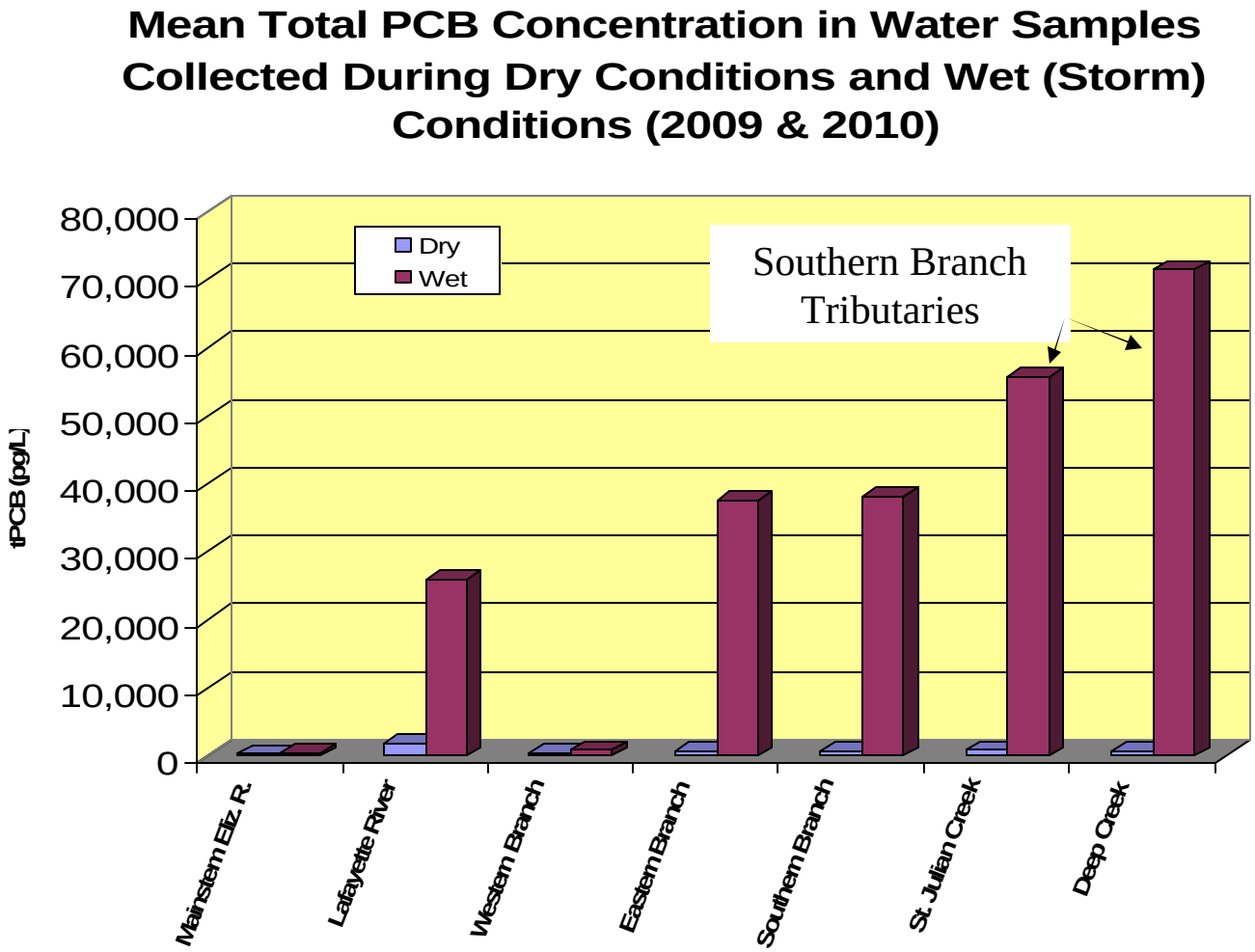
Section	Station ID	Mean PCBs (pg/L)
Willoughby	2-WLY000.00	290
Lafayette	2-LAF005.01	38,675
Western Branch	2-WBE004.44	858
Eastern Branch	2-EBE000.40	50,788
	2-EBE004.96	94,804
	2-IND000.98	2,167
	2-BRO001.35	2,506
Southern Branch	2-SBE000.57	2,368
	2-SBE001.53	4,014
	2-STJ000.81	55,907
	2-SBE006.26	61,187
	2-SBE008.40	36,636
	2-DEC000.58	71,499

WQC = 640 pg/L

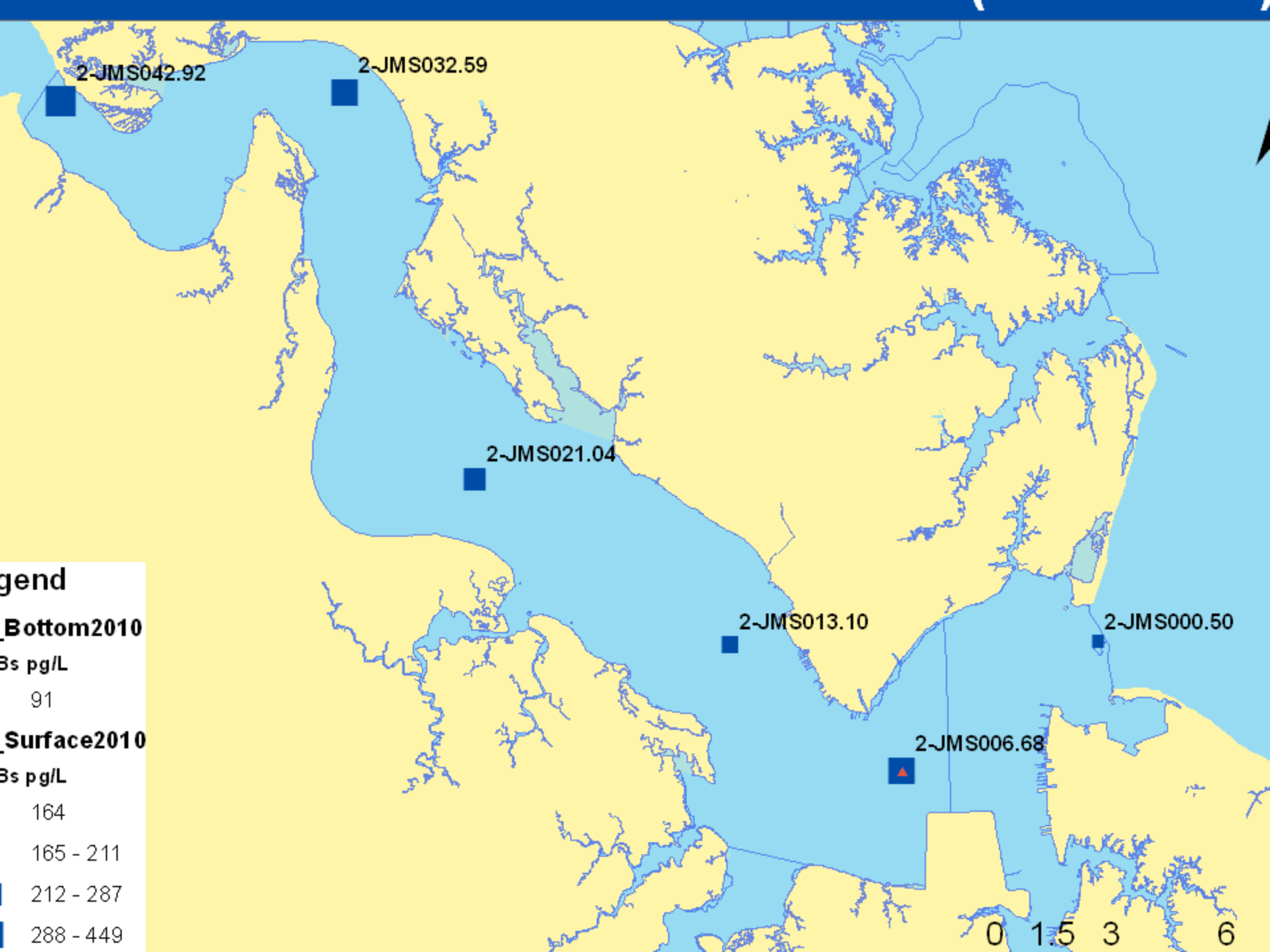
Sample Size = 2



tPCB Water Results

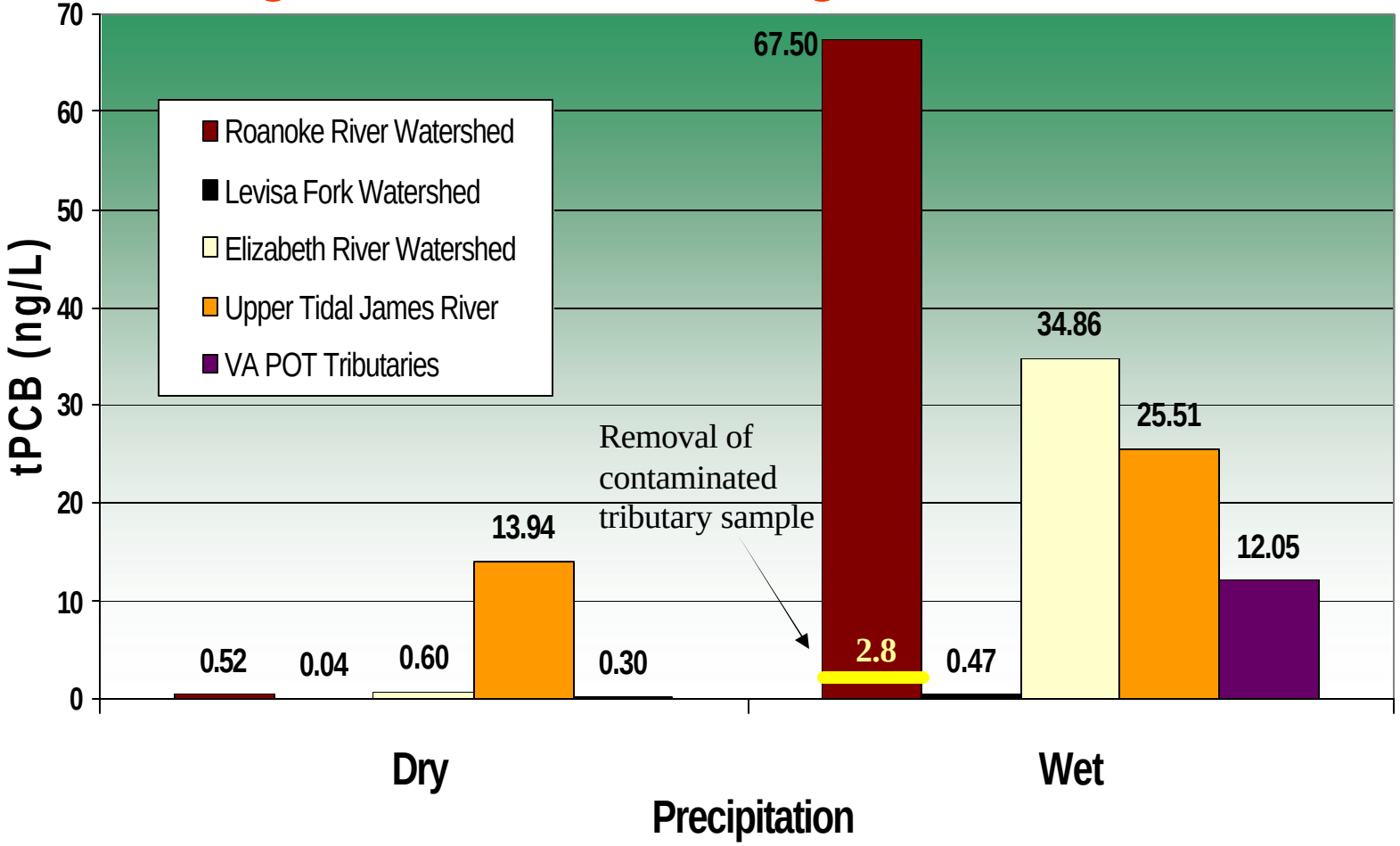


Water Quality Criterion = 640 pg/L


2-JMS042.92
2-JMS032.59
2-JMS021.04
2-JMS013.10
2-JMS000.50
2-JMS006.68
gend
_Bottom2010
Bs pg/L
91
_Surface2010
Bs pg/L
164
165 - 211
212 - 287
288 - 449
0 1.5 3 6

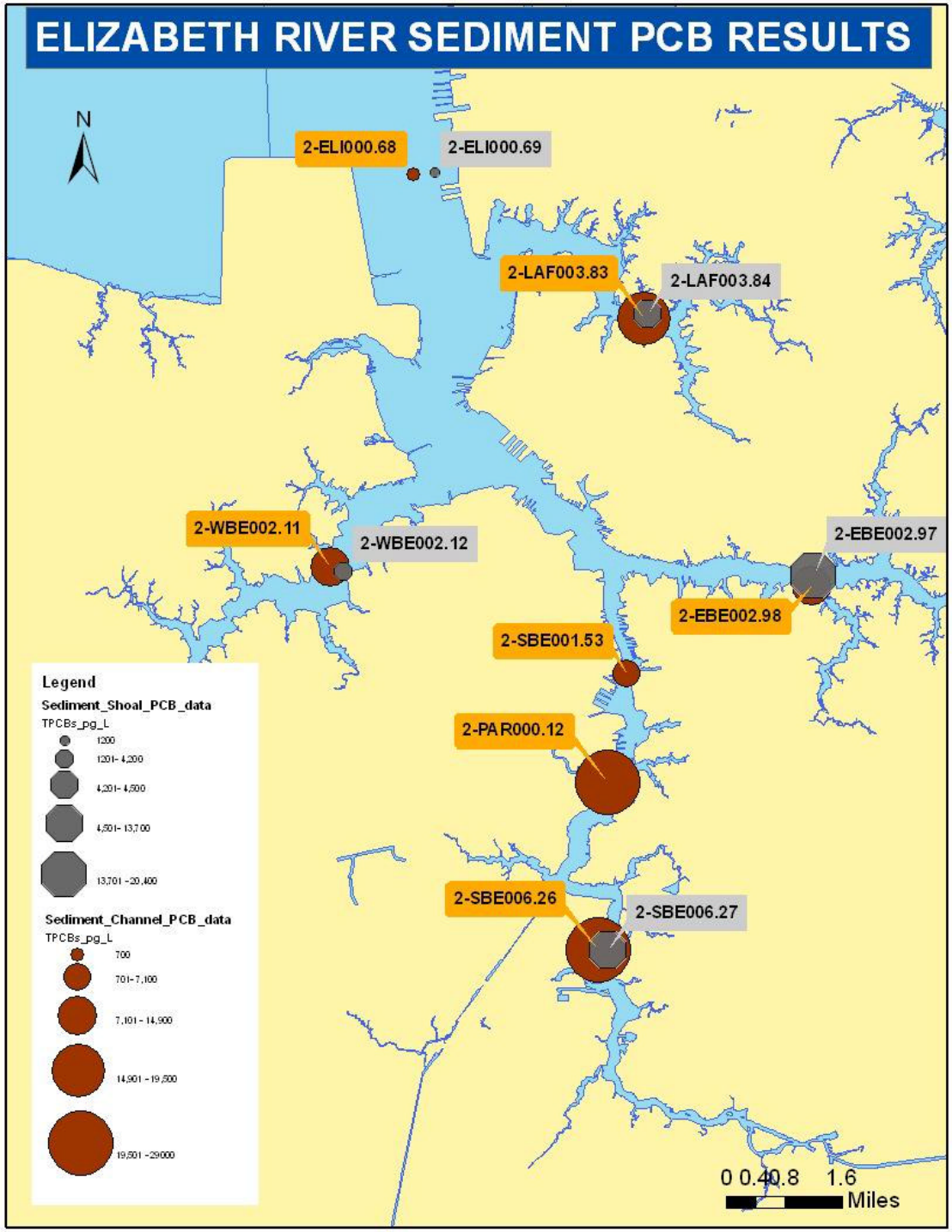
Mean tPCB Concentrations from Ambient Water in Five Watersheds Collected Before and After Precipitation Events

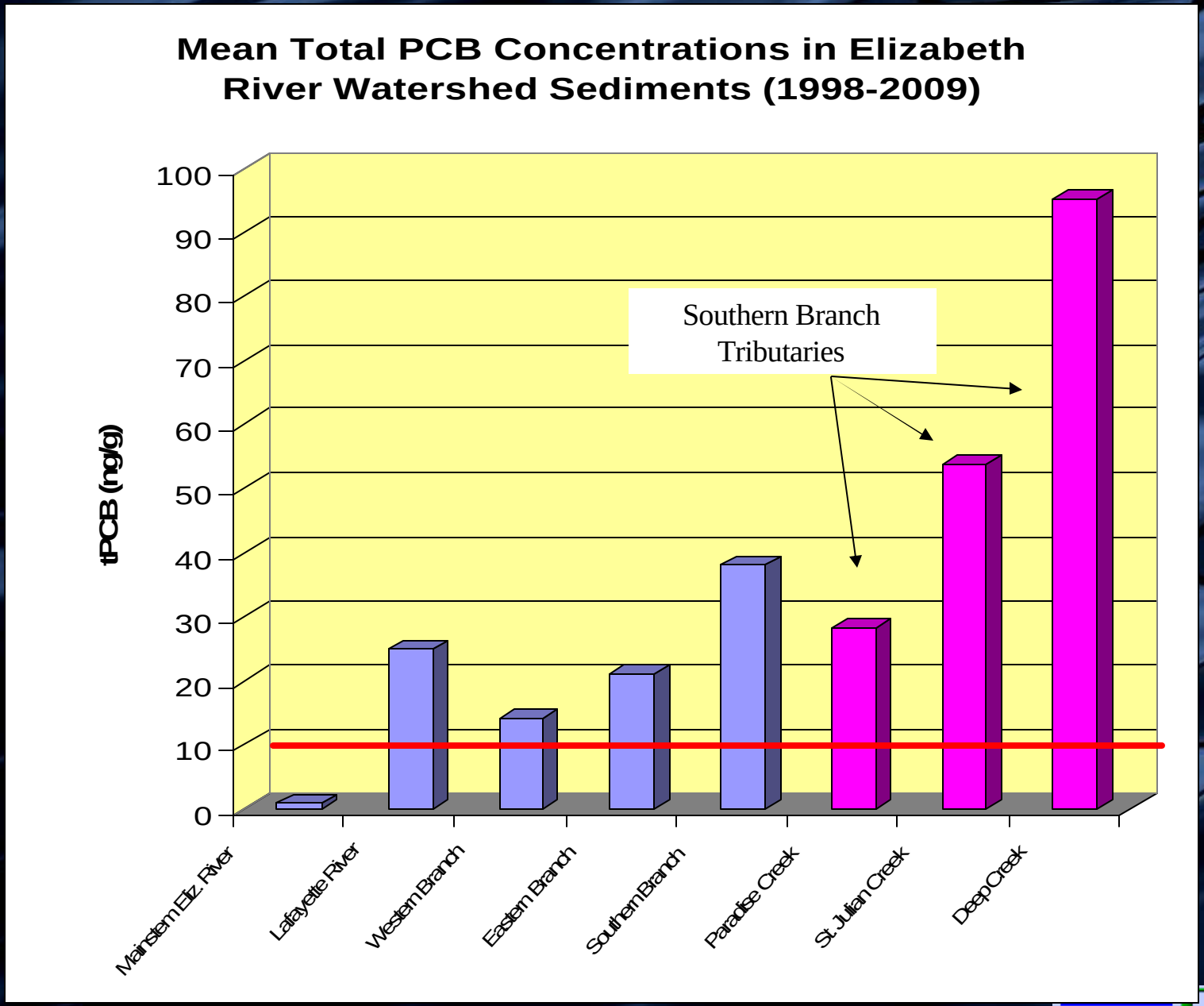
Note change in units – WQC = 0.64 ng/L



Sediment Data

Section	Station ID	Total PCBs Channel/Shoal (pg/g)
MainStem	2-ELI000.68/69	715/1,183
Lafayette	2-LAF003.83/84	19,458/4,410
Western Branch	2-WBE002.11	14,869/4,137
Eastern Branch	2-EBE002.97/98	12,251/2,0397
Southern Branch	2-SBE001.53	7,069
	2-PAR00.12	28,257
	2-SBE006.26/27	28,902/13,618

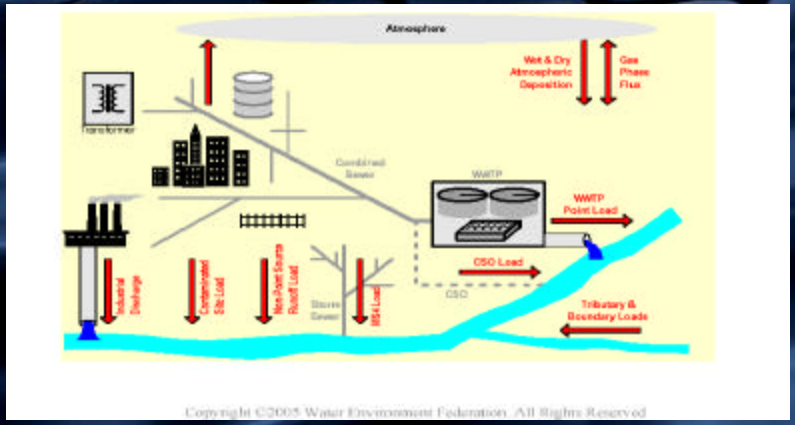




Site Specific threshold (7.6 ng/g) based on Potomac River TMDL

TMDL Source Assessment
- Load Categories-

- Point Sources
  - WWTPs, Industry, Industrial SW, CSOs
  - MS4
- Non-Regulated Stormwater (Direct Drainage)
- Contaminated Sites
- Atmospheric Deposition
- River Sediment



Components of TMDL Study

Fish Consumption Advisory

→ Identify Problem

On-going →

Source Assessment
- Identify sources
- Estimate source loading

← **Method 1668** Low Level PCB Analysis

Link Sources to Targets
- Assess linkages
- Estimate total loading capacity

TMDL Allocations
- Divide loads among sources

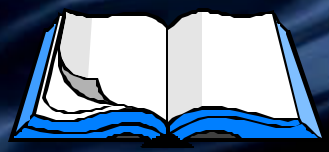
TMDL = Sum of WLA + Sum of LA + MOS

Tidal James River PCB TMDL

What Next?

Total Maximum Daily Load

Implementation



- Identifies permit controls, best management practices, or remediation options needed to make necessary pollutant reductions

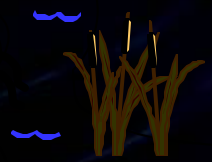
We Are Here

- Calculates amounts from each source
- Tracks pollutants in the system
- Sets maximum pollutant load
- Estimates necessary pollutant reductions

Implementation

Clean

Water quality standards met



Water quality standards not met

The Process

DEQ

TMDL Development Questions?

Presentations and Handouts Available at:
http://www.deq.virginia.gov/tmdl

DEQ PCB Website:
http://www.deq.virginia.gov/tmdl/pcb.html